Location: QA Officer's Office
pH laboratory
SOP Files

1.0 SCOPE

1.1 To measure pH in water samples.

2.0 SUMMARY OF METHOD

2.1 This SOP is designed to measure the pH of water samples. The procedure in this method is written for the Hach SensION3 Laboratory pH Meter (P/N 51750-18). This SOP follows EPA method 4500 H^+ B.

3.0 INTERFERENCES

3.1 Temperature can be an interference. Temperature can change the acid-base equilibrium constant.
3.2 Carbon Dioxide absorption from the atmosphere. This can form carbonic acid in water, which can cause interferences.
3.3 A pH above 10 can have sodium interference.

4.0 APPARATUS AND MATERIALS

4.1 Hach SensION3 Laboratory pH Meter (P/N 51750-18).
4.2 Platinum Series Combination pH Electrode with Temperature (Cat. #: 51910-00)
4.3 Potassium Chloride Electrolyte Cartridge (Cat.#: 25469-02)
4.4 Stir Plate
4.5 Magnetic Stir Bar
4.6 Plastic Cup
4.7 Paper Towel
4.8 50 mL Centrifuge Tubes

5.0 REAGENTS

5.1 pH, 4.00, color-coded red
5.2 pH, 7.00, color-coded yellow
5.3 pH, 10.00, color coded blue
5.4 pH, 5.00, color coded clear (Laboratory Control Sample), Micro Essential Lab Hydrion Products prepared by adding 1 pill per 100mL of DI Water
5.5 pH, 2.00, color coded clear, , Micro Essential Lab Hydrion Products prepared by adding 1 pill per 100mL of DI Water

6.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

6.1 pH analyses must be run as soon as possible after sample collection. The samples must be stored in an unpreserved plastic container.

7.0 PROCEDURE

7.1 Turn on the meter.
7.2 Inspect the Potassium Chloride Electrolyte Gel Cartridge to ensure that it is not empty. If it is empty replace it.
7.3 Prime the electrode by pushing the dispenser until gel comes out of the reference junction. Rinse excess gel from the tip and the outlet with deionized (DI) water.
7.4 Press the <CAL> button on the meter. The display will prompt for Standard 1 (pH= 7.00).
7.5 Place the electrode into fresh pH=7 buffer. Then press <Read/Enter> and stir until the display reads "pH STD 2. "Fresh" is defined as prepared within 7 days of calibration.
7.6 Remove the electrode from the pH=7 buffer and rinse it well with DI water, dry with a paper towel.

7.7 Place the electrode into pH=4 buffer. Stir and press <Enter>. Wait until the display prompts for STD 3, then press exit. This is a two point calibration.

7.8 The Slope and "Store?" will appear. If the slope is –58 +/- 3mV/ph Unit record it along with the pH readings of the two buffers on the bench sheet. If the slope is out of this range press <Exit> and recalibrate. Then press <Read/Enter> to save the calibration.

7.9 Remove the electrode from the buffer, rinse well with DI water and dry with a paper towel. The display will now automatically switch to the pH reading mode (i.e. "4.00 pH").

7.10 Place the electrode into pH=10 buffer, stir and wait until the reading is stable. The display must show 10.00 ± 0.05 pH units. Record this value on the bench sheet. If it is out of this range recalibrate until it reads in this range. Calibration is now complete. Recalibrate every 10 samples or every day whichever comes first.

7.11 Remove the electrode, rinse well with DI water, pat dry with paper towel, and place it into the Laboratory Control Sample (LCS).

7.12 Stir and wait for a stable pH reading on the display. Ensure that the pH reading for the LCS is with in the certified acceptance range.

7.13 Remove the electrode, rinse well with DI water. Place the electrode into the sample and stir. Wait until the display shows a stable pH reading and the sample has a temperature near (± 5^{o}C) the temperature of the buffers (room temperature).

7.14 Record all buffer readings, LCS, sample and sample duplicate readings as well as the temperature displayed on the small monitor in the pH bench book along with the Merit Sample Number, the date and your initials.

7.15 Replace the sample with a new aliquot and repeat the test (duplicate analysis).

7.16 Note that the samples and the pH buffers used for calibrating the instrument must be close to the sample temperature (+/- 5 ^{o}C).

7.17 After samples are tested. Read the LCS buffer at the end to ensure that the meter remained in calibration. If it reads beyond the range pH=5± 0.05 recalibrate and reread the samples.

7.18 To increase accuracy perform a calibration check at least every 10 samples. Recalibrate as needed.

7.19 Remove the electrode, rinse well with DI water, pat dry with a paper towel and place it in the overnight beaker containing East Lansing, MI tap water.

8.0 QUALITY CONTROL

8.1 All QA/QC information that needs to be analyzed are listed in the "Quality Control Requirements" table below.

8.2 This table also includes acceptable upper and lower limits, any corrective actions not specified in the procedures.

Quality Control Requirements

QC Work Task	Frequency	Acceptance Range	Corrective action
Calibration with two Std buffers (pH=7 & 4) plus third Std buffer (pH=10) verification	1/day and when calibration check is outside acceptance range	± 0.05 of pH Slope = -58=±3mV/pH unit	1. Clean electrode and reference junction. Then recalibrate. 2. Prepare new buffers and recalibrate. 3. Call for service.
Laboratory Control Sample	1/day or every 10 samples	Within certified range	Same as for calibration above.
Temperature of samples and Buffers	Record with each pH reading	Within ± 5°C of the buffers (room temperature	Hold at room temperature until within acceptable range.
Calibration check buffer pH 2.00 and pH 5.00	1/set or every 10 samples	± 0.05 pH units	Recalibrate and rerun samples read since the last acceptable calibration check.
End calibration check Read one standard	1/set or 1/day	± 0.05 pH units	Recalibrate and rerun samples read since the last acceptable calibration check

9.0 DOCUMENTATION

9.1 pH Bench book that records the following information:

- 9.1.1 Date of Standards Made, Expiration, and Calibration Value
- 9.1.2 Calibration information (buffer used, value read)
- 9.1.3 LCS values
- 9.1.4 Calibration Check
- 9.1.5 Lot #'s for Buffer Solutions
- 9.1.6 Calibration Slope Value
- 9.1.7 Merit ID Number
- 9.1.8 Date
- 9.1.9 pH Measured
- 9.1.10 Temperature at which the pH is measured
- 9.1.11 Matrix
- 9.1.12 Analyst Initials

10.0 METHOD PERFORMANCE

10.1 This method is evaluated by the blinds performed every quarter. If the pH values are not within the acceptable criteria, a the matter is investigated and a corrective plan is determined.

11.0 REFERENCES

11.1 *Standard Methods*, twentieth edition, Method 4500-H^+ B.

12.0 SAFETY

12.1 Eye protection and gloves must be worn while performing pH analyses.

12.2 Every Laboratory area has eyewash, emergency shower, and fire extinguisher. The metals lab also has dust masks available for use with dust samples.

12.3 The air system through out the laboratory area is on a 100% fresh air exchange system, this system exchanges 100% the air in the laboratory area with air from outside 6 times per hour and 30 times per hour when the emergency purge button is hit.

12.4 A reference file of material safety data sheets (MSDSs) is available to all personnel.

13.0 WASTE DISPOSAL AND POLLUTION PREVENTION

13.1 All laboratory waste must be managed, stored, and disposed in accordance with all federal and state laws and regulations.

13.2 Additional information can be found in the Sample Disposal SOP and Merit's Waste Management Plan and Handbook.

14.0 APPROVAL & ISSUE

14.1 This section indicates which personnel have read, accepted and approved the SOP. All analysts involved with the SOP must acknowledge their comprehension of the SOP with a signature and a date.

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Analyst Date

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Andy Ball, QA Officer Date

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Maya V. Murshak, Technical Director Date